

CLAIMS

What is claimed is:

1. A conductive line structure for a field effect transistor (FET) based magnetic random access memory (MRAM) device, comprising:
 - a lateral metal strap (326) conductively coupled to a lower metallization line (302);
 - 5 a magnetic tunnel junction (MTJ) stack (316) formed on said metal strap (326);
 - a metal shield (324) formed over said MTJ stack (316), said metal shield (324) being self-aligned with respect to said metal strap (326); and
 - an upper metallization line (332) conductively coupled to said metal shield (324), wherein said metal shield (324) serves as an etch stop during the formation of
 - 10 said upper metallization line (332).
2. The structure of claim 1, wherein said MTJ stack (316) further comprises:
 - a non-magnetic layer (106) formed between a lower magnetic layer (104) and an upper magnetic layer (106); and
 - 5 a metal hardmask layer (314) formed on said upper magnetic layer (106);
 - wherein the distance between said upper metallization line (322) and said upper magnetic layer (106) is defined by a total thickness of said metal hardmask layer (314) and said metal shield (324).
3. The structure of claim 2, wherein said total thickness of said metal hardmask layer (314) and said metal shield (324) is about 400 to about 500 angstroms.
4. The structure of claim 1, wherein said metal shield (324) comprises one of: tantalum, tantalum nitride, titanium nitride, tungsten, platinum, and combinations comprising at least one of the foregoing.

5. The structure of claim 1, wherein said metal hardmask layer (314) and said metal strap (326) comprise one of: tantalum, tantalum nitride, titanium nitride, tungsten, platinum, and combinations comprising at least one of the foregoing.

6. The structure of claim 1, wherein:

said lower metallization line (302) is formed at first metallization level (M1) of the MRAM device, and said upper metallization line (332) is formed at a second metallization level (M2) of the MRAM device.

7. The structure of claim 1, further comprising:

a wordline (108) formed at a lower metallization level (M1) and adjacent said lower metallization line (114), said wordline (108) electrically insulated from said lateral metal strap (326), and said wordline (108) disposed below said MTJ stack (316);

5 wherein said upper metallization line (332) comprises a bitline (110) of an individual MRAM cell (102), said cell (102) also including said MTJ stack (316) and said wordline (108).

8. A method for forming the conductive line structure of claim 1, the method comprising:

forming a magnetic stack layer (312) over a metal underlayer (310), said metal underlayer (310) in conductive contact with said lower metallization line (302);

5 forming a metal hardmask layer (314) over said magnetic stack layer (312);

patterning said magnetic stack layer (312) and said metal hardmask layer (314) so as to form said magnetic tunnel junction (MTJ) stack (316);

encapsulating said MTJ stack (316) with dielectric material (318) and planarizing said dielectric material (318) to said metal hardmask (314);

10 forming a metal shield layer (320) over said dielectric material and said metal hardmask (314);

patterning both said metal shield layer (320) and said metal underlayer (310) so as to form said metal shield (324) that is self-aligned with said metal strap (326); and

15 forming said upper metallization line (332) on said metal shield (324), wherein said metal shield (324) serves as an etch stop during the formation of said upper metallization line (332).

9. The method of claim 8, wherein said metal hardmask layer (314) is planarized to a thickness of about 200 angstroms prior to the formation of the metal shield layer (320) thereupon.

10. The method of claim 8, wherein said MTJ stack (316) further comprises:

a non-magnetic layer (106) formed between a lower magnetic layer (104) and an upper magnetic layer (106); and

said a metal hardmask layer (314) formed on said upper magnetic layer (306);

5 wherein the distance between said upper metallization line (322) and said upper magnetic layer (106) is defined by a total thickness of said metal hardmask layer (314) and said metal shield (324).

11. The method of claim 10, wherein said total thickness of said metal hardmask layer (314) and said metal shield (324) is about 400 to about 500 angstroms.

12. The method of claim 11, wherein said metal hardmask layer (314) is deposited at an initial thickness of about 500 angstroms prior to planarization thereof.

13. The method of claim 8, wherein said metal shield layer (320) comprises one of: tantalum, tantalum nitride, titanium nitride, tungsten, platinum, and combinations comprising at least one of the foregoing.

14. The method of claim 8, further comprising:

following said patterning of said metal shield layer (320) and said metal underlayer (310), encapsulating said self-aligned metal shield (324) and said metal strap (326) with an encapsulating dielectric (308); and

5 depositing an upper metallization level dielectric (330) over said encapsulating dielectric (308).

15. The method of claim 8, wherein said conductive contact between said metal underlayer (310) and a lower metallization line (302) is formed by a metal strap via (306).